

12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

(10) Referring to FIG. 4, an enlarged perspective view of the optoelectronic module's potting box 64 is depicted. The potting box 64 forms the outer housing of the optoelectronic module. The potting box 64 is generally rectangularly shaped and has a top surface 64a, a bottom surface 64b, and side surfaces 64c, 64d.

# United States Patent

Poplawski et al.

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## REMOVABLE OPTOELECTRONIC MODULE

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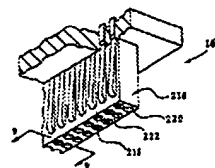
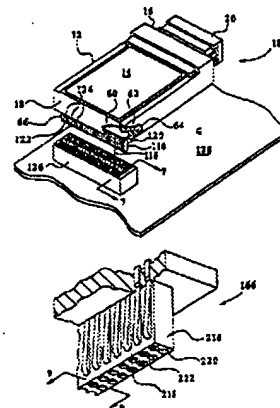
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## ABSTRACT

A removable optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material inserted therein. In addition, a circuit board is secured by the potting material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Consequently, a recess cover is provided for forcing a rigid light and between the recess cover, the potting box, and the optical subassembly.

17 Claims, 3 Drawing Sheets



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DOCUMENT-IDENTIFIER: JP 10133791 A  
TITLE: OPTICAL RADIO TRANSMISSION DEVICE, INTERFACE, AND PORTABLE INFORMATION TERMINAL  
PUBN-DATE: May 22, 1998  
INVENTOR-INFORMATION:  
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COUNTRY  
N/A

APPL-NO: JP08302431  
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INT-CL (IPC): G06F003/00, H04B010/105, H04B010/10, H04B010/22

## ABSTRACT:

PROBLEM TO BE SOLVED: To provide an optical radio transmission device, interface, and portable information terminal which make it easy to connect an electronic device such as a personal computer to a LAN (local area network)

SOLUTION: The optical radio transmission device 15 has a light emitting element 1 and a light receiving element to send and receive data with light, and also has optical transmission and reception parts which are arranged having their optical transmission and reception directions set to the same direction, driving devices 6 and 10 which can adjust the optical transmission and reception directions of the optical transmission and reception parts with a specific three-dimensional angle range, and a direction control part which controls the driving devices so that the optical transmission and reception parts have maximum optical transmission and reception intensity. Further, the interface has the optical radio transmission device mounted on a plug-in card.

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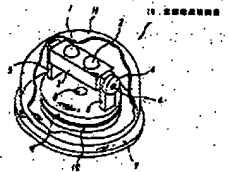
(10) 日本特許庁 (JP) (11) 公開特許公報 (A) (12) 特許公開番号  
特開平10-133791  
(13) 公開日 平成10年05月22日

特許請求の範囲	発明の名称	発明の要旨
1. 光放射素子と光受信素子とを有する光学無線伝送装置、インターフェース及び携帯情報端末装置。	光学無線伝送装置、インターフェース及び携帯情報端末装置	光放射素子と光受信素子とを有する光学無線伝送装置、インターフェース及び携帯情報端末装置。

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(17) 出願人 00034329  
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特許庁特許部特許第10区目第13丁目15番  
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## G0 (3) 特許の名称: 光放射素子、インターフェース及び携帯情報端末装置

(3) (要約)  
【課題】 パソコンなどの電子装置を容易にLANに接続することを実現する光無線伝送装置、インターフェース及び携帯情報端末装置を提供する。  
【解決手段】 光放射素子と光受信素子とを有し、光によってデータを伝送するに当たり、光放射素子及び光受信素子を有し、伝送光の方向を調整して光無線伝送装置と接続することにより、伝送光の強度を調整して伝送光の強度を最大にするように調整装置を制御する方向制御部を有するものである。また、インターフェースはこの光無線伝送装置をプラグイン・カードに搭載したものである。



転するが、プラグ2側の光ファイバー心線1の端面は、受・発光面6bが円環状であるために常に受・発光面6bに対向する。このため、固定機器からの電気信号は、光ファイバーの心線1の端面及び受・発光ダイオード4、6におけるE/O変換を経てドラムDのケーブル10に確実に伝達される。又、逆に光ファイバーケーブル心線1からの光信号は、それを受光ダイオード4、6が受けO/E変換されてケーブル10'に伝達される。

なお、プラグ2側に受・発光ダイオード6を固着するようにしてもよい。

また、実施例において、受・発光ダイオード4、6を中心から発光ダイオード、受光ダイオードと適宜に選択して配置すれば、送信と受信の双方向伝達をすることができる。

さらに、受・発光素子aの配置態様としては、実施例以外に、固定側をA又はB、回転側をB又はAとすると、例えば、第4図(a)、(b)、(c)など種々考えられる。

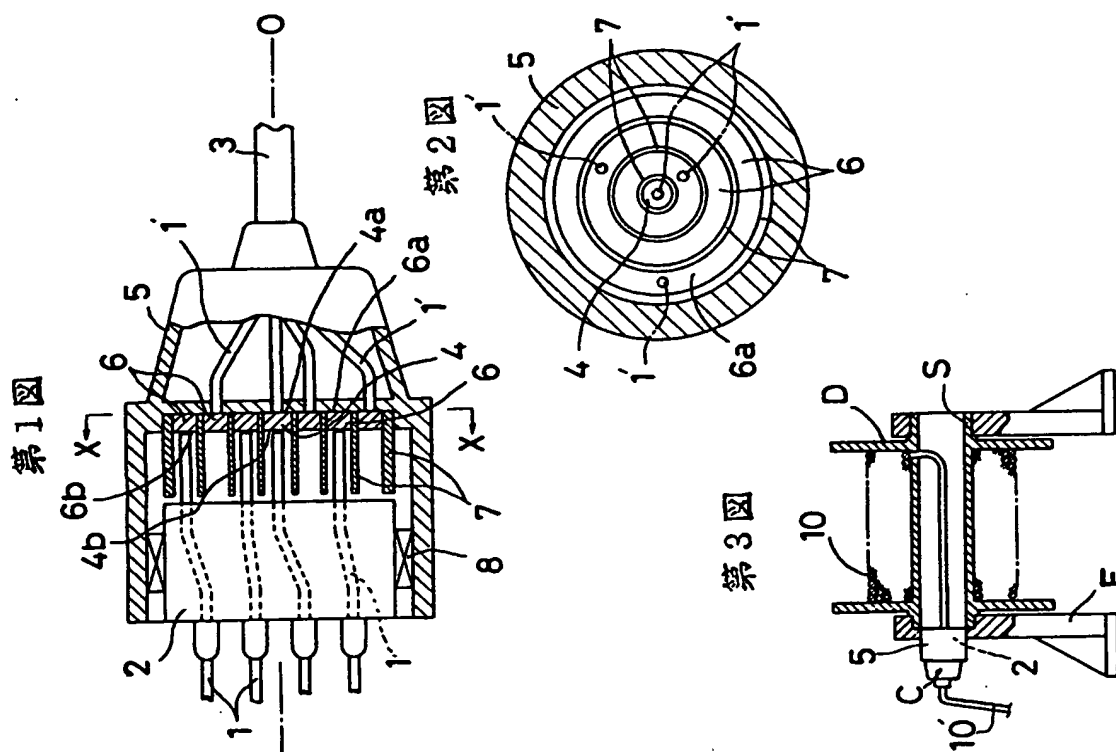
(発明の効果)

以上説明した如く、本発明の多心光ロータリーコネクタによれば、コネクタ自身がO/E、E/O変換機能を併せもっているため、別途に、O/E、E/O変換器あるいは合波器、分波器を必要とせず、伝送系全体の設備費用を安価にすることができると共に、光軸のずれが生じた場合でも伝送影響を少なくし得て、ロータリーコネクタの寿命も長くする事ができる等の効果を有する。

#### 4. 図面の簡単な説明

第1図は本願発明に係る多心光ロータリーコネクターの一実施例の断面図、第2図は第1図のX-X線断面図、第3図は同実施例の使用説明図、第4図(a)~(c)は他の各実施例の概略図である。

1……光ファイバー心線、1'……リード線、2  
……プラグ、5……レセプタクル、6……円環状  
面受・発光ダイオード、7……遮蔽板、10……  
光ケーブル、6b……受・発光面。



第4図

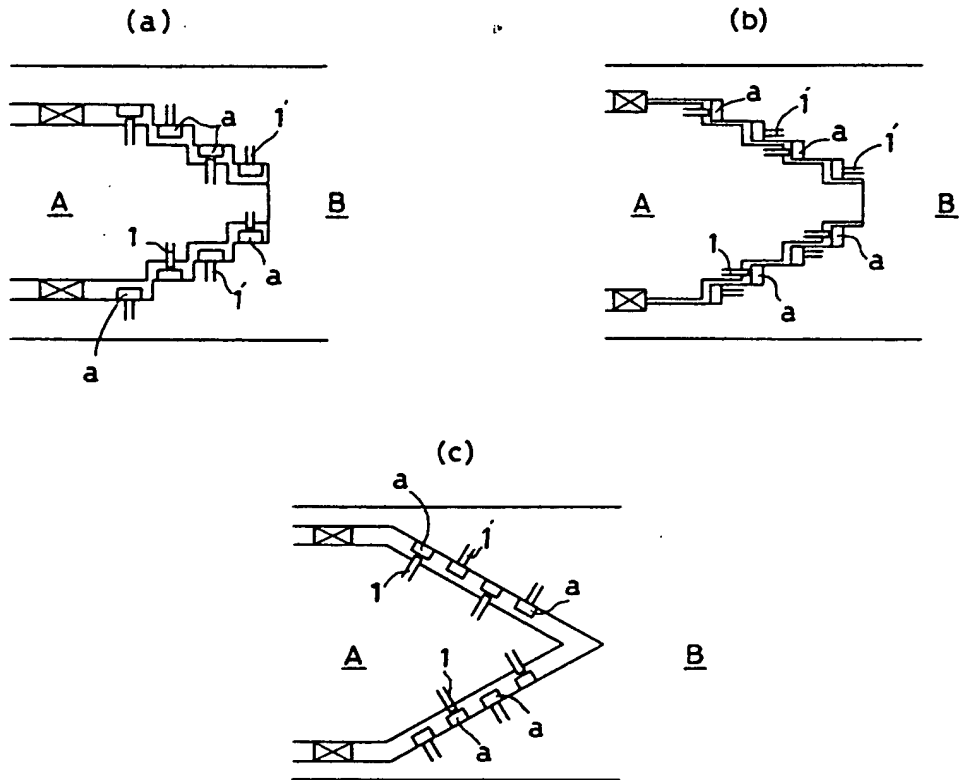




FIG. 11 is a plan view of the alternative embodiment shown in FIG. 10 but in a mated orientation.

# DETAILED DESCRIPTION:

## (1) DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

(2) Referring to the drawing, and particularly to FIG. 1, an enlarged perspective view of an optoelectronic transceiver module 10 in accordance with the present invention is depicted. The module 10 has a main housing 12 which generally has the shape of an oblong box. The main housing 12 has a generally rectangular top 14 with a first end 16 and an opposite second end 18 extending perpendicularly from the top. Attached to the first end 16 of the main housing 12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing

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Papirowski et al.

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## REMOVABLE OPTOELECTRONIC MODULE

## FOREIGN PATENT DOCUMENTS

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0 421 486 A1 11/1984 European Pat. Off. 0228 900

(\*) Status: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,346,331.

Primary Examiner—Leo P. Picard  
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Attorney Agent, or Firm—David L. Newman

(21) Appl. No.: 086,316

(22) Filed: Jun. 7, 1995

## Related U.S. Application Data

(53) Continuation-in-part of Ser. No. 477,814, Apr. 4, 1995, and Ser. No. 372,783, Apr. 13, 1995, Ser. No. 3,943,291.

(51) Int. Cl.<sup>6</sup>: H01L 27/00; H01L 27/02; H01L 27/04

(52) U.S. Cl.: 361/332; 361/333; 361/334; 361/335

(58) Field of Search: 361/332-335, 361/336-337, 361/338-339, 361/340-341, 361/342-343, 361/344-345, 361/346-347, 361/348-349, 361/350-351, 361/352-353, 361/354-355, 361/356-357, 361/358-359, 361/360-361, 361/362-363, 361/364-365, 361/366-367, 361/368-369, 361/370-371, 361/372-373, 361/374-375, 361/376-377, 361/378-379, 361/380-381, 361/382-383, 361/384-385, 361/386-387, 361/388-389, 361/390-391, 361/392-393, 361/394-395, 361/396-397, 361/398-399, 361/400-401, 361/402-403, 361/404-405, 361/406-407, 361/408-409, 361/410-411, 361/412-413, 361/414-415, 361/416-417, 361/418-419, 361/420-421, 361/422-423, 361/424-425, 361/426-427, 361/428-429, 361/430-431, 361/432-433, 361/434-435, 361/436-437, 361/438-439, 361/440-441, 361/442-443, 361/444-445, 361/446-447, 361/448-449, 361/450-451, 361/452-453, 361/454-455, 361/456-457, 361/458-459, 361/460-461, 361/462-463, 361/464-465, 361/466-467, 361/468-469, 361/470-471, 361/472-473, 361/474-475, 361/476-477, 361/478-479, 361/480-481, 361/482-483, 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and 238 of each contact beam 230 resiliently urges against the frontstop 248.

(31) Access for making an electrical connection with the contact beams 230,230 is provided since they protrude from the male ribbon style connector 166 in the area around the bends 238,238. Correspondingly, in order to make an electrical connection between a female ribbon style connector and the resilient male ribbon style connector 166, the distal end 222 of the male ribbon style connector is inserted within a slot provided by the female connector. As the male ribbon style connector 166 is pushed within the female connector, the two rows of contact beams 230,230 will be forced to compress towards each other. In addition, each contact beam 230 will resiliently urge against a corresponding electrical contact mounted within the female ribbon style connector. Thus, an electrical connection will be formed between the male ribbon style connector's electrical contact beams 230,230 and the female connector's contact beams.

(32) Similarly, to disconnect the resilient male ribbon style connector 166 from the female connector, the male connector is simply pulled from the female connector. Once the male ribbon style connector 166 has been removed, the contact beams 230,230 will resiliently regain the configuration of FIG. 9, whereby the second end 236 of each contact beam will abut its corresponding frontstop 248.

(33) An alternative embodiment of the present invention is shown in FIG. 10 having a main housing 312, having a first end 316 and a second end 318. As discussed in the previous embodiments, the housing 312 includes optical subassemblies for sending transmission over a data link and receiving transmissions over a data link. The preferred embodiment is an optoelectronic transceiver, however, a simplex transmitter or receiver or multiple transmitters or receivers may be incorporated in the module housing of the alternative embodiment. At the first end 316 is a transceiver connector 320 for receiving fiber optic plugs. In an alternative embodiment, optical fibers may be directly attached to the module and the optical subassemblies therein. At the second end 318 is a pluggable connector 366. In the preferred embodiment, the pluggable connector 366 is a D-shaped connector having a printed circuit board 368 having multiple contact traces 370 adhered thereto. The transceiver housing 312 is pluggable into receptacle 310 and is inserted into the receptacle 310 in direction of arrow 300. The receptacle 310 includes a receptacle housing 370 having a top 372 and sides 374,375. The receptacle housing 370 includes an open end 376 and a closed end 378. At the closed end 378 of the receptacle housing 370 is a connector 380 for mating with the pluggable connector 366. The connector 380 protrudes into the interior of the receptacle housing 370 and has an aperture for receiving the pluggable connector 366 of the transceiver housing 312. In the preferred embodiment, the connector 380 is a female connector for receiving the male connector 366. However in an alternative embodiment, the pluggable connector 366 of the transceiver housing 312 may be a female connector and the connector 380 of the receptacle housing 370 would be a male connector. Protruding from the connector 380 are contacts 382 for direct connecting to a printed circuit board in a peripheral device such as a work station or computer to wire the connector 380 directly to traces of a printed circuit board. In an alternative embodiment, a flat ribbon cable for transmitting the electrical signals protrudes from the transceiver module. The receptacle housing 370 includes in sides 374,375 aperture 384 for providing the locking of the transceiver within the receptacle housing 370.

(34) The transceiver housing 312 includes a pair of release levers 350,351. The description of release lever 350 is the same of that for 351. The release lever 350 includes a first end 353 which is attached to the side of the transceiver housing 312. In a preferred embodiment, the release lever 350 is integrally molded with the transceiver housing 312. The release lever 350

United States Patent (17)  
Poplawski et al.

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REMOVABLE OPTOELECTRONIC MODULE

FOREIGN PATENT DOCUMENTS

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(\*) Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,346,231.

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ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which contains a printing box with printing material inserted therein. In addition, a circuit board is inserted by the printing material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the printing box through a recess. Correspondingly, a screen cover is provided for housing a rigid light end between the screen cover, the printing box, and the optical subassembly. The module housing may be pluggable via release levers having apertures located in apertures of a receptacle and a pluggable connector of the module mated within the receptacle.

Related U.S. Application Data

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(51) Int. Cl. 6: H04B 10/00 (1989) 06/00

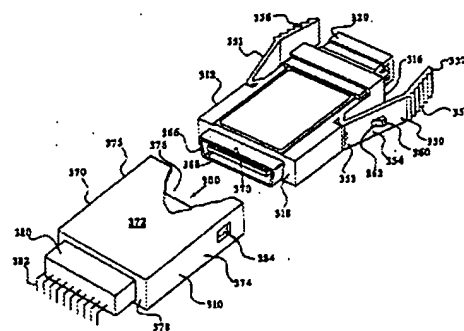
(52) U.S. Cl. 360/392; 361/277; 362/321

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9 Claims, 9 Drawing Sheets



12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangular shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

(10) Referring to FIG. 4, an enlarged perspective view of the optoelectronic module's potting box 64 is depicted. The potting box 64 forms the outer

# United States Patent (9)

Poplawski et al.

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## REMOVABLE OPTOELECTRONIC MODULE

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19 Claims, 7 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 4

# BRIEF SUMMARY:

## (1) FIELD OF THE INVENTION

(2) This invention relates to connecting both electrical power and optical data signals to a device for receiving and sending such signals over a fiber optic conductor in an optical data signal network or portion thereof; more specifically the invention relates to a plug and receptacle for simultaneously connecting the electrical conductors for supplying electrical power to a using device and aligning and connecting fiber optic conductors to juxtapose the ends of the fiber optic conductors in close proximity, thereby facilitating transmission of optical data signals from one of the fiber optic conductors to another.

## (3) BACKGROUND OF THE INVENTION

(4) Many data processing and transmission devices, especially personal computers, are electrically powered by connections to standard household receptacles and also are networked or interconnected by wide area and local area networks with other computers, servers and related data processing and transmission devices. This permits the rapid and accurate interchange of data between interconnected computers.

(5) Typically, the higher capability computers are networked or interconnected over a network at least some of which is comprised of fiber optic transmission lines; the lower capability computers are interconnected to networks through an electrical data connection, and the electrical signal may be further converted to an optical signal by converters or transceivers within the network.

(6) Optical signals have vast advantages over digital or analog electrical signals because optical signals are not affected by electrical interference from other electrical or electronic devices positioned close to the optical fiber data transmission lines and the data bandwidth of optical conductors is much greater than corresponding electrical conductors, thereby permitting the rapid transmission of much larger amounts of data.

(7) As the cost of electronic to optical and optical to electronic conversion devices or transceivers are reduced with wider spread usage and the speeds of data transmission are increased, it is highly desirable to carry the optical signal as close to the using device as possible. This necessitates the optical signal transmitting fiber optic conductors must be easily and reliably connected to the fiber optic conductor network; typically, this is accomplished with a specialized connector on the ends of two fiber optic cables. The electrical power connections for the devices have remained relatively standard.

(8) In the future, it is anticipated that computers and servers and related data using or transmitting devices will be designed with optical signal capability. Moreover, "dumb" devices (those which do not use external data), such as home heating and air conditioning units, toasters, coffee makers, and other household appliances that presently do not use optical signals for their external control data input such as televisions will either incorporate optical signal capability in their functions or be controllable by programmable

# United States Patent

Smith

(a) Patent No.: US 6,533,466 B1  
(4) Date of Patent: Mar. 18, 2003

## (14) HYBRID CONDUCTOR ASSEMBLY FOR ELECTRICAL CONDUCTORS AND FIBER OPTIC DATA CONDUCTORS

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 27 days.

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(7) U.S. Pat. No. 5,434,398 uses a magnetic encoding process to establish the identity with a card based system. Modulated magnetic fields embedded in a smart card require the use of a ferromagnetic element to retain the unique identity code. A magnetic reader decodes the card information allowing system activation. Exposure of this system to radio frequency energy used in electrosurgery, could effect the integrity of the magnetic smart card and degrade the ability of the magnetic based card reader to accurately decode its proper identity. Radio frequency energy would remagnetize both the smart card and reader by induced magnetic coupling to the ferromagnetic elements. Clearly this system would require magnetic shielding to retain identity data. Indeterminate magnetic sources present in the operating room also creates additional major problems for this system and would make its use in electrosurgery suspect.

(8) U.S. Pat. No. 5,396,062 describes a power source receptacle system with detection of the presence of a mated plug, by using an optical coupling technique, established by beam passage through the receptacle. This approach uses a light emitter to generate a beam, that passes through openings in the receptacle contacts, to a receiver aligned on a dedicated optical axis. A powered instrument having a bladed plug for insertion in a receptacle breaks the beam transmission path sending a corresponding signal to a controller that detects the plug engagement. The '062 patent is limited in use, in that, it provides for detection when a mating plug is either inserted or removed from the receptacle. Power can only be activated or deactivated in the receptacle, based on whether the mating plug is engaged or disengaged. Numerous problems are presented by this system. First, the identity is not recognized or associated to a given instrument plugged into the receptacle. Second, the power applied to the receptacle cannot be differentiated between specific pluggable instruments. Also, additional problems are presented, because a specific optical axial alignment is required for beam passage, through the openings in the power receptacle contacts, thereby requiring a specific mechanical alignment integrity.

(9) U.S. Pat. No. 5,625,370 has an electromagnetic device and method in an identification system apparatus. An electrically conductive material is disposed to pass through a magnetic flux loop of the electromagnetic device. The coupling established between those components is the means by which identification information is transferred. An antenna may also be electrically connected to the conductive material to augment the apparatus for receiving transmitted identification information. Multiple identification problems exist with radio frequency based equipment due to radiation coupling with the electromagnetic conductive strip and antenna which will deteriorate the identity signals. Error borne signals lose their identity and become inaccurate with decoding. The radio frequency energy may also electromagnetically couple to distort the magnetic flux loop of the electromagnetic device. This will reduce the signal to noise ratio during information transfer and lower the accuracy of the identity information recovered.

(10) International Patent WO9608794 has a security code identification circuit that uses a radio frequency based card reader and decoder method to recover a digital security code. The card reader includes a receiving antenna sensitive to a signal generated to an access card. A receiver circuit is coupled to the receiving antenna to detect and process an analog signal that is then converted to a digital security code. A problem with this type of recognition system makes it error borne and unacceptable for code identification in radio frequency systems. Radio frequency energy contains components that will be picked up and coupled by the reader receiving antenna as it is sensitive to those frequencies. This will confuse the card reader



US 6402743 B1

# United States Patent Orszulik et al.

(a) Patent No.: US 6,402,743 B1  
(4) Date of Patent: Jun. 11, 2002

(54) SMART RECOGNITION APPARATUS AND METHOD

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5,400,567 A 11/97 Shultz  
5,800,000 A 12/97 Shultz et al.  
6,046,363 A 12/00 Nis et al.  
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(73) Inventors: James Henry Orszulik, Natick, Mass.  
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Inventors of US (10)

WO 96/04004 11/96  
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Primary Examiner—Ray Gibson  
(57) ASSTRACT

(72) Assignee: Sherwood Services AG, Schaffhausen (CH)

A qualifying connection for an instrument system to a source of electromagnetic energy and to the instrument and has first and second parts coupled to the instrument and the source, respectively. Optical couplings on the connection transmit infrared energy to identify the instrument and are positioned on the first and second parts. A light modulator on the first part is pivotal to the second part for modification of addition to the infrared wavelengths as infrared transmission encodes signals and encodes; coded primary detection on the second part on the coupled detection. Mechanical attachments include coupling male and female portions physically connecting between the parts for mating engagement. An identifying circuit couples to the second part and responds to infrared light optically communicated across the couplings for verifying the type of instrument connected by the cable to the source. A method of using the connection line steps including: (a) connecting and coupling the parts with attachments and couplings for transmitting infrared optical energy to identify the instrument. The method includes modifying the infrared optical energy with geographically disposed portions couplings of the parts when the attachments engage and the couplings are positioned. Reading and decoding signals of the modified energy are transmitted through the connection and to a security device in the source.

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/126,389  
(22) Filed: Mar. 17, 2000

Related U.S. Application Data

(67) Continuation of application No. 08/853,321 filed on Dec. 17, 1997, now Pat. No. 6,233,677.

(51) Int. Cl. A61B 1/04; A61B 1/18

(52) U.S. Cl. 606/34; 606/41; 607/101

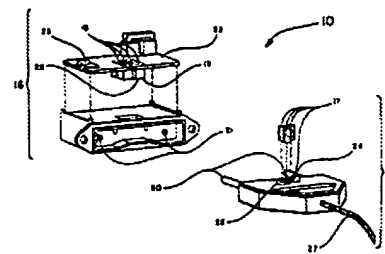
(53) Field of Search 606/34, 37, 41, 406/4, 10-11, 41-52; 607/4, 58, 100-102, 113

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5,344,338 A 8/94 Linn et al.  
5,396,062 A 11/97 Orszulik et al.  
5,600,361 A 11/99 Orszulik et al.  
5,613,775 A 10/99 Orszulik et al.  
5,625,370 A 11/99 Orszulik et al.  
5,625,370 A 11/99 Orszulik et al.

18 Claims, 3 Drawing Sheets



(36) Access for making an electrical connection with the contact beams 230, 230 is provided since they protrude from the male ribbon style connector 166 in the area around the bends 238, 238. Correspondingly, in order to make an electrical connection between a female ribbon style connector and the resilient male ribbon style connector 166, the distal end 222 of the male ribbon style connector is inserted within a slot provided by the female connector. As the male ribbon style connector 166 is pushed within the female connector, the two rows of contact beams 230, 230 will be forced to compress towards each other. In addition, each contact beam 230 will resiliently urge against a corresponding electrical contact mounted within the female ribbon style connector. Thus, an electrical connection will be formed between the male ribbon style connector's electrical contact beams 230, 230 and the female connector's contact beams.

(37) Similarly, to disconnect the resilient male ribbon style connector 166 from the female connector, the male connector is simply pulled from the female connector. Once the male ribbon style connector 166 has been removed, the contact beams 230, 230 will resiliently regain the configuration of FIG. 9, whereby the second end 236 of each contact beam will abut its corresponding frontstop 248.

(38) An alternative embodiment of the present invention is shown in FIG. 10 having a main housing 312, having a first end 316 and a second end 318. As discussed in the previous embodiments, the housing 312 includes optical subassemblies for sending transmission over a data link and receiving transmissions over a data link. The preferred embodiment is an optoelectronic transceiver, however, a simplex transmitter or receiver or multiple transmitters or receivers may be incorporated in the module housing of the alternative embodiment. At the first end 316 is a transceiver connector 320 for receiving fiber optic plugs. In an alternative embodiment, optical fibers may be directly attached to the module and the optical subassemblies therein. At the second end 318 is a pluggable connector 366. In the preferred embodiment, the pluggable connector 366 is a D-shaped connector having a printed circuit board 368 having multiple contact traces 370 adhered thereto. The transceiver housing 312 is pluggable into receptacle 310 and is inserted into the receptacle 310 in direction of arrow 300. The receptacle 310 includes a receptacle housing 370 having a top 372 and sides 374, 375. The receptacle housing 370 includes an open end 376 and a closed end 378. At the closed end 378 of the receptacle housing 370 is a connector 380 for mating with the pluggable connector 366. The connector 380 protrudes into the interior of the receptacle housing 370 and has an aperture for receiving the pluggable connector 366 of the transceiver housing 312. In the preferred embodiment, the connector 380 is a female connector for receiving the male connector 366. However in an alternative embodiment, the pluggable connector 366 of the transceiver housing 312 may be a female connector and the connector 380 of the receptacle housing 370 would be a male connector. Protruding from the connector 380 are contacts 382 for direct connecting to a printed circuit board in a peripheral device such as a work station or computer to wire the connector 380 directly to traces of a printed circuit board. In an alternative embodiment, a flat ribbon cable for transmitting the electrical signals protrudes from the transceiver module. The receptacle housing 370 includes in sides 374, 375 aperture 384 for providing the locking of the transceiver within the receptacle housing 370.

(39) The transceiver housing 312 includes a pair of release levers 350, 351. The description of release lever 350 is the same of that for 351. The release lever 350 includes a first end 353 which is attached to the side of the transceiver housing 312. In a preferred embodiment, the release lever 350 is integrally molded with the transceiver housing 312. The release lever 350



US 6267606 B1

(17) United States Patent  
Poplawski et al.

(20) Patent No.: US 6,267,606 B1  
(45) Date of Patent: Jul. 31, 2001

(14) REMOVABLE TRANSCIVER MODULE AND RECEPTACLE

INT. CL. H01M 01/00 (2006.01) H01M 01/00 (2006.01)

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(List continued on next page.)

(72) Assignee: Stratus Lightwave, Inc., Chicago, Ill. (US)

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(\*) Note: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(d) by 0 days.

OTHER PUBLICATIONS

This patent is subject to a written disclaimer.

Electronic Specifications E59117-N-302

(31) Appl. No.: 09/218,743

HF Module HF58-6103, FDDI Data Sheet

(32) Filed: Apr. 28, 1999

An optical Data Link using a CD laser.

Related U.S. Application Data

(List continued on next page.)

(33) Continuation of application No. 08/877,200 filed on Jan. 13, 1997, which is a continuation of application No. 08/628, 071, filed on Oct. 4, 1996, now Pat. No. 5,594,400, which is a continuation of application No. 08/314,614, filed on Aug. 14, 1995, which is a continuation of application No. 08/045,815, filed on Jan. 7, 1993, now Pat. No. 5,254,419, which is a continuation of application No. 08/017,470, filed on Jan. 13, 1993, now Pat. No. 5,117,470, which is a continuation of application No. 07/912,762, filed on Jan. 13, 1992, now Pat. No. 5,142,231.

Primary Examiner—Paula Bradley  
Assistant Examiner—Edwin A. Lyle  
(74) Attorney, Agent, or Firm—David L. Newman

(37) ABSTRACT

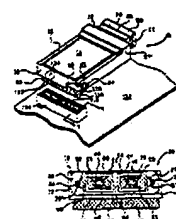
A removable optoelectronic transceiver module which is quick, easy and inexpensive to manufacture. The transceiver module has a main housing which contains a circuit board having an optical subassembly mounted thereon. The module housing may be pluggable via a resilient member received within the receptacle. The module and receptacle assembly may include grounding means such as a ground clip disposed within a gap provided between the module and a connector part of the receptacle to limit electromagnetic interference.

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Re. 32,852 01/87 Exam. 43972

36 Claims, 9 Drawing Sheets



one preferred embodiment is depicted. The module 10 has a generally oblong box. The main housing 12 has a generally rectangular top 14 with a first end 16 and an opposite second end 18 extending perpendicularly from the top. Attached to the first end 16 of the main housing 12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.



US06201704B1

(15) United States Patent  
Poplawski et al.

(16) Patent No.: US 6,201,704 B1  
(45) Date of Patent: Mar. 13, 2001

(54) TRANSCIVER MODULE WITH RMT  
ENCLOSING

(73) Inventors: Daniel S. Poplawski, Schenectady;  
James W. MacChesney, Schenectady;  
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(72) Assignee: Sprint Lightwave, Inc., Chicago, IL  
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(\*) Notice: This patent is based on a continued prosecution application filed under 37 CFR 1.53(a), and is subject to the priority year grace term provisions of 35 U.S.C. 154(d)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: 08/972,519  
(22) Filed: Jan. 16, 1997

Related U.S. Application Data

(35) Continuation of application No. 08/177,314, filed on Apr. 6, 1993, and a continuation-in-part of application No. 08/772,780, filed on Jan. 13, 1996, now Pat. No. 5,574,281.

(31) Int. Cl.: H04B 10/00  
(32) U.S. Cl.: 361/280; 361/272; 361/299; 361/416; 361/518; 361/529; 361/534

(56) Field of Search: 361/280, 361/272, 361/299, 361/416, 361/518, 361/529, 361/534; 438/64-66; 438/75.1, 131, 133, 79, 77, 490, 495, 496, 499, 502; 375/432, 433

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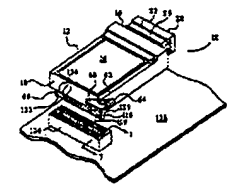
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ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which comprises of a potting box with potting material encased therein. In addition, a circuit board is encased by the potting material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forcing a light seal and between the recess cover, the potting box, and the optical subassembly.

21 Claims, 4 Drawing Sheets



(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

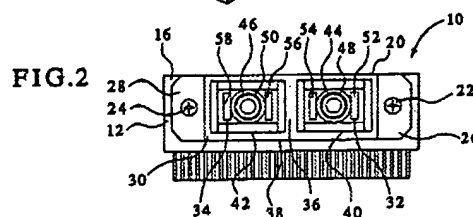
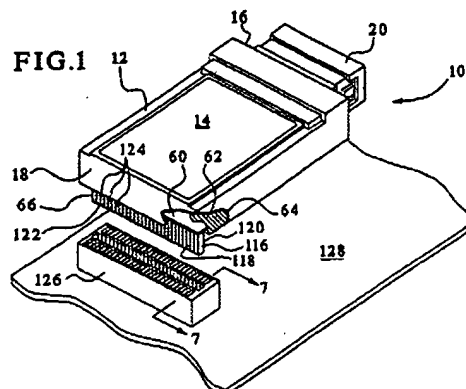
(10) Referring to FIG. 4, an enlarged perspective view of the optoelectronic module's potting box 64 is depicted. The potting box 64 forms the outer housing of the optoelectronic module. Thus, the potting box generally has the

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800 MHz and 900 MHz spread-spectrum RF signals are in wide use for this purpose. Because of the short distances normally involved in the present invention, amplitude-modulated infrared (IR) beams also serve well. In this case, a conventional, very inexpensive infrared emitter and photodetector substitute for RF antenna 233. The invention contemplates the use of any other shortrange, low-power wireless technologies as well.

(11) FIG. 2D shows a base station 240 packaged in a single physical module or enclosure 241. This module has an enclosure 241 adapted to sit in a small area of a desktop, shelf, or similar space; its internal circuits occupy no more volume than those of cards 220 or 230. Antenna 242 radiates and receives RF energy representing digital data from and to the base station. The wireless communications data format and signal type matches those of remote station 230. Therefore, any of the modalities employed there are useful here. For example, an IR emitter/detector may replace RF antenna 242. A conventional wall-wart power supply plugs into an AC power line to provide low-voltage direct-current power to the base station via cord 244. PCMCIA slot 245 accepts modem card 220, shown in dotted lines. Its telephone jack 223 connects to a telephone-system wall outlet as described above.

(12) FIG. 2E shows an alternative form 250 of the base station. Here, the enclosure 251 also incorporates a power transformer, and connects directly to an AC outlet via plug 252 and cord 253. Modem 220 plugs into PCMCIA slot 254. In this embodiment, modem 220 sends and receives telephone signals via its PCMCIA connector from a telephone jack 255 physically mounted in enclosure 251. Jack 255 then connects to the telephone system. Antenna 256 exchanges RF, optical, or other wireless signals in the same manner as antenna 242, FIG. 2C.

(13) FIG. 3 is a block-diagram rendering of the interconnection of the components shown in FIG. 2.

(14) FIG. 3A illustrates a wired configuration wherein computer 210 attaches directly to modem 220, which in turn transfers data by a wire to telephone system 360. Computer interface connector 154 delivers data to mating interface connector 222 of modem 220. This data normally takes the form of a bitstream in RS-232 format or some other conventional format. This form is termed "baseband" herein, because the data has a more or less raw form; however, this term is intended to include any data format in which a computer delivers data to a modem for further transmission to an external network.

(15) Block 321 converts the baseband data from connector 222 to modulated form according to any of the numerous protocols from manufacturers and from the international standards organization CCITT, such as V.42, V42bis, V.fast, etc. Although this modulated data is called "CCITT data" herein, that term is to be understood as encompassing all forms of data adapted to be transmitted on system 360; for example, an Integrated Services Digital Network (ISDN) system employs a high-speed unmodulated bitstream divided into multiple channels. Some implementations of conventional block 321 employ hard-wired circuits, the most common present-day converter is a single-chip programmed digital signal processor. Block 322 realizes a conventional data access arrangement (DAA) for modifying the electrical parameters the CCITT data to those of system 360, and for protecting system 360 against harm from any malfunction of modem 220. DAA 322 transfers data to and from a standard connector such as RJ11 plug 223. As mentioned earlier, other forms of connector are also available, and may be preferred in some embodiments. In fact, some modems may include multiple plugs, such as the X-jack connector shown at 323.

(16) Controller block 323 implements conventional flow-control and housekeeping functions; it can be hardwired or programmable. Block 324 optionally converts baseband data to and from a standard RS-232 format.

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FIG. 2D

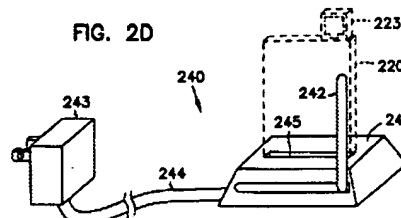
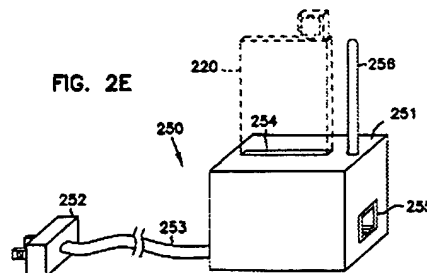


FIG. 2E







Connector. Thus, an electrical connection will be formed between the male ribbon style connector's electrical contact beams 230, 230 and the female connector's contact beams.

[0085] Similarly, to disconnect the resilient male ribbon style connector 166 from the female connector, the male connector is simply pulled from the female connector. Once the male ribbon style connector 166 has been removed, the contact beams 230, 230 will resiliently regain the configuration of FIG. 9, whereby the second end 236 of each contact beam will abut its corresponding frontstop 248.

[0086] An alternative embodiment of the present invention is shown in FIG. 10 having a main housing 312, having a first end 316 and a second end 318. As discussed in the previous embodiments, the housing 312 includes optical subassemblies for sending transmission over a data link and receiving transmissions over a data link. The preferred embodiment is an optoelectronic transceiver, however, a simplex transmitter or receiver or multiple transmitters or receivers may be incorporated in the module housing of the alternative embodiment. At the first end 316 is a transceiver connector 320 for receiving fiber optic plugs. In an alternative embodiment, optical fibers may be directly attached to the module and the optical subassemblies therein. At the second end 318 is a pluggable connector 366. In the preferred embodiment, the pluggable connector 366 is a D-shaped connector having a printed circuit board 368 having multiple contact traces 370 adhered thereto. The transceiver housing 312 is pluggable into receptacle 310 and is inserted into the receptacle 310 in direction of arrow 300. The receptacle 310 includes a receptacle housing 370 having a top 372 and sides 374, 375. The receptacle housing 370 includes an open end 376 and a closed end 378. At the closed end 378 of the receptacle housing 370 is a connector 380 for mating with the pluggable connector 366. The connector 380 protrudes into the interior of the receptacle housing 370 and has an aperture for receiving the pluggable connector 366 of the transceiver housing 312. In the preferred embodiment, the connector 380 is a female connector for receiving the male connector 366. However in an alternative embodiment, the pluggable connector 366 of the transceiver housing 312 may be a female connector and the connector 380 of the receptacle housing 370 would be a male connector. Protruding from the connector 380 are contacts 382 for direct connecting to a printed circuit board in a peripheral device such as a work station or computer to wire the connector 380 directly to traces of a printed circuit board. In an alternative embodiment, a flat ribbon cable for transmitting the electrical signals protrudes from the transceiver module. The receptacle housing 370 includes in sides 374, 375 aperture 384 for providing the locking of the transceiver within the receptacle housing 370.

[0087] The transceiver housing 312 includes a pair of release levers 350, 351. The description of release lever 350 is the same of that for 351. The release lever 350 includes a first end 353 which is attached to the side of the transceiver housing 312. In a preferred embodiment, the release lever 350 is integrally molded with the transceiver housing 312. The release lever 350 includes a second end 352 which includes a gripping portion 355 which has lined edges to assist in gripping of the release lever 350. Intermediate to the first end 353 and the second end 352 is an intermediate portion 354. The intermediate portion 354 angles outwardly away from the sides of the transceiver housing 312. Attached at the end of the intermediate portion 354 is the second end 352 which is generally parallel to the side of the transceiver housing 312. However, as the intermediate portion 354 angles outward and away from the side of the transceiver housing 312, the second end 352 is at a distance from the sides of the transceiver housing 312 in its normated condition. Protruding from the intermediate portion 354 is detente 360. The detente 360 includes an engagement surface 362. Upon insertion of the transceiver housing 312 into the receptacle 370, the intermediate portion



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(15) United States

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(34) REMOVABLE TRANSCIVER MODULE AND RECEPTACLE

Publication Classification

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(52) U.S. Cl. 438/98

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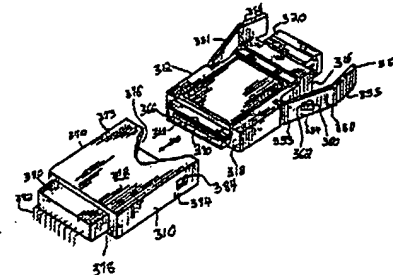
(57) ABSTRACT

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Related U.S. Application Data

(43) Continuation of application No. 08/516,113, filed on Aug. 14, 1995, which is a continuation-in-part of application No. 08/085,310, filed on Jan. 7, 1993, now Pat. No. 5,734,878, and which is a continuation-in-part of application No. 08/427,574, filed on Apr. 6, 1995, now Pat. No. 5,717,823, and which is a continuation-in-part of application No. 08/172,780, filed on Jan. 14, 1994, now Pat. No. 5,544,381.

A removable optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material inserted therein. In addition, a shock board is mounted by the potting material. The shock board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forming a liquid light seal between the recess cover, the potting box, and the optical subassembly. The module housing may be pluggable via release levers having detents received in apertures of a receptacle and a pluggable connector of the module extend within the receptacle. The receptacle may include grounding means such as a ground clip mounted within the receptacle and a protective door to limit electromagnetic emissions.



rectangular top 14 with a first end 16 and an opposite second end 18 extending perpendicularly from the top. Attached to the first end 16 of the main housing 12 is a transceiver connector 20 for receiving fiber optic plugs.

[0080] Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

[0081] In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

[0082] Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

[0083] The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

[0084] Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

[0085] Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

[0086] In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

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## OPTOELECTRONIC TRANSCEIVER MODULE AND RECEPTACLE

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Related U.S. Application Data

Continuation of application No. 08/500,543, filed on Aug. 1, 1999, now Pat. No. 6,237,606, which is a continuation of application No. 08/097,210, filed on Aug. 1, 1994, now Pat. No. 6,222,678, which is a continuation of application No. 08/338,877, filed on

Oct. 4, 1995, now Pat. No. 5,864,448, which is a continuation-in-part of application No. 08/315,813, filed on Aug. 14, 1995, which is a continuation-in-part of application No. 08/483,310, filed on Jan. 7, 1996, now Pat. No. 5,794,551, which is a continuation-in-part of application No. 08/418,874, filed on Aug. 7, 1995, now abandoned and which is a continuation of application No. 08/073,960, filed on Jan. 13, 1995, now Pat. No. 5,544,281.

## Publication Classification

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(52) U.S. Cl. 438/763

## ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a circuit board having an optical subassembly mounted thereon. The module housing may be plugable via a reaction member received within the receptacle. The module and receptacle assembly may include grounding means such as a ground clip mounted within a gap provided between the module and a connector part of the receptacle to limit electromagnetic radiation.

